Methamphetamine Exposures in Young Children

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Objectives: Methamphetamine abuse is reaching epidemic proportions. As this occurs, the likelihood of accidental poisoning in children increases. We sought to evaluate the presentation, treatment, and outcome of pediatric methamphetamine exposures reported to the California Poison Control System.

Methods: This is a retrospective review of California Poison Control System records for methamphetamine exposure from 2000 through 2004. All charts of patients identified as younger than 6 years were reviewed and abstracted.

Results: The charts of 47 children younger than 6 years were identified and reviewed. Three were coded as minor effects, 3 as major effects, and 16 as moderate effects. The remainder of the charts were not evaluated because of no effect (n = 6), unrelated or confirmed nonexposure (n = 3), or unable to follow (n = 16). The most common presenting symptom was agitation (82%), whereas seizures were documented in only 2 cases (9%). Tachycardia was common (mean heart rate, 171 beats/min; confidence interval [CI], 154–187), whereas blood pressure (BP) (mean systolic BP, 120 mm Hg; CI, 104–136; and mean diastolic BP, 70 mm Hg; CI, 51–88) and rectal temperature (mean, 37.4°C; CI, 36.9–37.9) were slightly elevated compared with normal values. Creatinine was documented in 6 cases and noted as normal in all (0.3 IU/L; CI, 0.2–0.4), whereas creatine kinase was documented in 3 charts and elevated in all (mean 1984 IU/L; range, 212–4942 IU/L). Most cases (55%) received benzodiazepines as treatment, although only 2 received activated charcoal. Symptoms persisted for an average of 22 hours (CI, 16.3–27.2). No deaths were reported.

Conclusions: In this series of children, methamphetamine exposure was strongly associated with agitation that was successfully treated with benzodiazepines. Tachycardia was common, although hypertension and hyperthermia were not. Laboratory studies were not routinely recorded. The clinical significance of elevated creatine kinase concentrations recorded in 3 children is unclear.

Key Words: illicit drug ingestion/poisoning, methamphetamines, toxicity

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Methamphetamine abuse is dramatically increasing in the United States and now exceeds that of any other illicit drug.[1] National Drug Threat Survey 2004 data indicate that, for the first time, the percentage of state and local agencies that identify methamphetamine as their greatest drug threat (39.6%) surpassed that of cocaine (35.6%), and is much higher than marijuana (12.0%), heroin (8.6%), or methylenedioxymethamphetamine (0.6%).[1] A total of 1.3 million persons aged 12 years or older used methamphetamine in 2002.[1] As such, the opportunity for exposures in infants and toddlers may also increase. In children less than 6 years of age, 99 exposures in 2003 and 109 exposures in 2004 were reported to the nation's poison control centers.[2,3]

Methamphetamine was first synthesized in 1893. It produces sympathomimetic effects by causing the release of catecholamines such as dopamine and norepinephrine from presynaptic nerve terminals.[4] In adults, this can lead to mydriasis, diaphoresis, hyperthermia, tachycardia, hypertension, agitation, and aggressive behaviors. Children, however, are less well studied, with only a few case reports and 1 case series in the literature. These reports suggest that in children, the most common presenting symptoms and signs were agitation, tachycardia, and vomiting.[5,6]

This study seeks to examine the characteristics of methamphetamine exposure in children less than 6 years of age that were reported to the California Poison Control System.

METHODS

After institutional review board approval, the Visual DotLab database of the California Poison Control System was queried for the keyword ''methamphetamine.'' Dates of inclusion were from January 1, 2000, through December 31, 2004. The subset of reports for children younger than 6 years was then abstracted onto standardized data sheets, and the data inputted into computerized spreadsheets (Microsoft Excel 2004 for Mac, Version 11.2.3). The charts were abstracted for the following characteristics: age, sex, history, symptoms/signs, drug detection test results, vital signs, laboratory values including creatine kinase, serum bicarbonate, serum creatinine, treatment, duration of symptoms, and coded level of severity (for definitions, see the legend for Table 1). Cases were excluded from analysis if the age was not documented, age was greater than 6 years, symptoms were determined not associated with methamphetamine exposures by specialists in poison information, no effect of potential exposure (asymptomatic), or unable to follow. Cases were included if the age was less than 6 years, and the level of severity was coded as minor, moderate, or major.

Statistics

Descriptive statistics were used to describe the data and were calculated using Microsoft Excel 2004 for Mac (Version 11.2.3).

RESULTS

A total of 2691 cases documenting methamphetamine exposures were identified; 47 were of children under the age of 6 years. This represents 1.75% of the total cases. The median age of the children was 12 months (range, 7–18 months). Twenty-two of these were minor, moderate, or major cases, and these are discussed in this article (Table 2).

On presentation, the most common symptom was agitation that was found in 82%. Seizures occurred in 2 cases (9%), and there were no reports of vomiting in any child. Mild elevations of heart rate, blood pressure (BP), and temperature were noted (Table 1). No information regarding the amount of methamphetamine ingested were obtainable in this data set. Laboratory studies were only documented in a minority of cases. Serum creatine kinase was documented in 3 cases and elevated in all (mean, 1984 IU/L; range, 212–4942 IU/L; normal value, <198 IU/L), whereas normal creatinine was documented in all 6 cases where it was tested. Serum bicarbonate was documented in 6 cases and was mildly decreased (mean, 20.3 mEq/L; 95% confidence interval [CI], 16.4–24.2). Urine immunoassays with confirmatory testing were noted in 10 of the cases (46%), and all were positive for methamphetamine, but the actual methods of testing were not specified. The most common treatment was benzodiazepines (55%), with 1 child receiving phenobarbital and 2 children receiving activated charcoal. Symptoms persisted for an average of 22 hours after presentation (95% CI, 16–27), and no deaths were reported in this data set.

DISCUSSION

Methamphetamine is currently one of the most common drugs of abuse, and its use seems to be increasing. It is easily manufactured from amphetamine, ephedrine, or pseudoephedrine. It is usually used by injection or inhalation of a smokable form known as ''ice,'' although it is rapidly absorbed after ingestion also. It is metabolized to amphetamine and hydroxymethamphetamine and is excreted renally with an elimination half-life of 12 to 34 hours.[8]

TABLE 1. Vital Signs Upon Presentation

Sign	Mean (95% CI)	Normal Values for a 1-Yr-Old Child[7]
Heart rate (beats/min)	171 (154–187)	119 (89–151)
Systolic BP (mm Hg)	120 (104–136)	<105 (90th percentile)
Diastolic BP (mm Hg)	70 (51–88)	<67 (girls; 90th percentile) <69 (boys; 90th percentile)
Temperature, rectal (°C)	37.4 (36.9–37.9)	37.0

TABLE 2. Outcome Data

Outcome	No. of Cases
Major	3
Moderate	3
Minor	16
No effect	6
Unrelated or nonexposure	3
Unable to follow	16

No effect indicates that the patient developed no signs or symptoms as a result of exposure; minor effect, the patient developed some signs or symptoms as a result of the exposure, but they were minimally bothersome and generally resolved rapidly with no residual disability or disfigurement; moderate effect, the patient exhibited signs or symptoms as a result of the exposure that were more pronounced, more prolonged, or more systemic in nature than minor symptoms. Usually some form of treatment is indicated. Symptoms were not life-threatening, and the patient had no residual disability or disfigurement; major effect, the patient exhibited signs or symptoms as a result of the exposure that were life-threatening or resulted in significant residual disability or disfigurement.[2,3]

Because of its increasing availability and use in adults, accidental exposure in young children is likely to become more common. Toxic doses vary widely in adults and are not well reported in children. In this study, the most common presenting symptom was agitation. This is in agreement with previous reports that report agitation, inconsolable crying, and irritability as common presentations.[5,6,9,10] The 2 seizures in this series are consistent with the only other seizure that was found in a series of 25 pediatric patients.[5] Other findings of sympathomimetic toxicity such as hyperthermia, tachycardia, and hypertension were milder than one would expect to find in adults and may be a function of a smaller quantity ingested by these children. Treatment with benzodiazepines seemed to be effective in decreasing agitation in this population.

A finding in this study were those of elevated serum creatine kinase levels measured in 3 children. This has not been reported previously. The most elevated level (4942 IU/L) was present in a child who presented with seizures. However, the other 2 cases (212 IU/L and 797 IU/L) were in children presenting with only agitation and no seizure activity documented. These levels are not likely clinically significant, but this finding warrants further study and suggests that serum creatine kinase or urine myoglobin concentrations should be considered in poisonings with severe symptoms because elevated levels may require specific therapy to prevent renal injury. Standard treatments for rhabdomyolysis include intravenous hydration to maintain urinary output and urinary alkalinization using sodium bicarbonate.

Limitations to this study include the retrospective nature of data collection and problems associated with using poison center data. These data depend upon voluntary communication from the primary care provider or facility and the ability of the poison center to gather detailed data and record detailed data. Providers who are familiar with the poisoning

may not call the poison center, and therefore, these cases will not be documented.

CONCLUSIONS

Agitation is the most common presenting symptom in young children poisoned with methamphetamines. Seizures occur in less than 10% of these cases. Elevated creatine kinase levels may be present in the absence of seizures and should be assessed in ill patients. In general, benzodiazepines are effective treatments for the agitation associated with methamphetamine poisoning and may be useful in young children.

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